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The Most Comprehensive Preparation App For All Exams

Lines & Angles and Polygons

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Geometry & Mensuration

(20-22)% of SSC Quant

* Lines & Angles + Polygons → (2)
  - (1) → Theory + Question (10)
  - (2) → Practice of Question + Basics of △ (150)
* Triangles → 4
* Quadrilateral → 4
* Circles → 3
* 2D → 4
* 3D → 6

Total → 23 classes 35 days

No. of Questions to be covered in this Module

Class
+
Homework
+
Quizzes

→ 800+

BASIC TERMS USED IN LINES AND ANGLES

Point : A point has no size or shape. It just tells **about the position.**

Line : a line can be defined as a straight one- dimensional figure that has no thickness and extends endlessly in both directions.

Line Segment : A line segment is a portion of a line that is two endpoints.

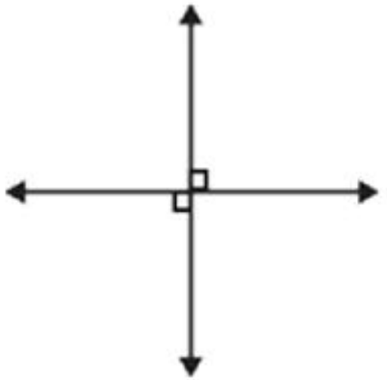
$\overline{PQ}$

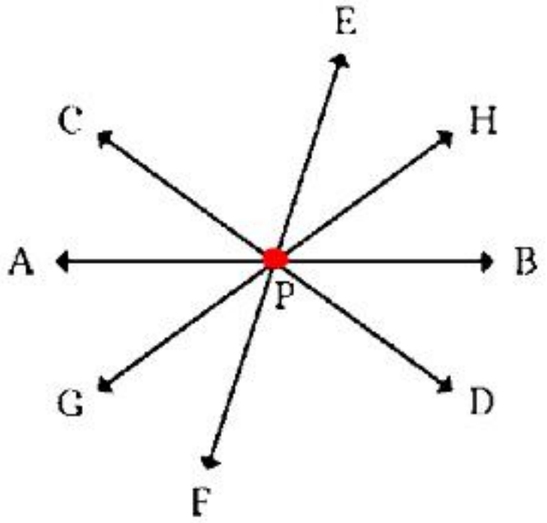
Ray : A ray is a portion of a line which has one endpoint and extends forever in one direction.

$\overrightarrow{PQ}$

Parallel Lines : Parallel lines can be defined as two lines in the same plane that are at equal distance from each other and never meet.

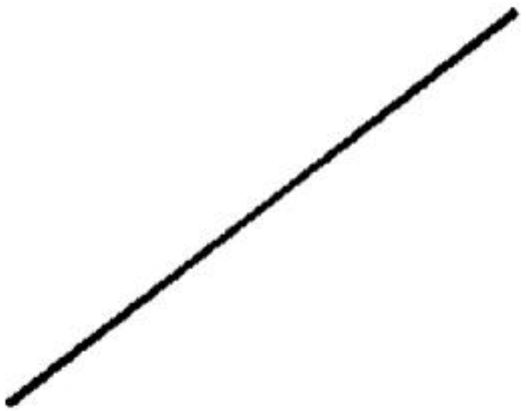
Perpendicular Lines: perpendicular lines are defined as two lines that meet or intersect each other at right angles (90°).





Concurrent Lines:

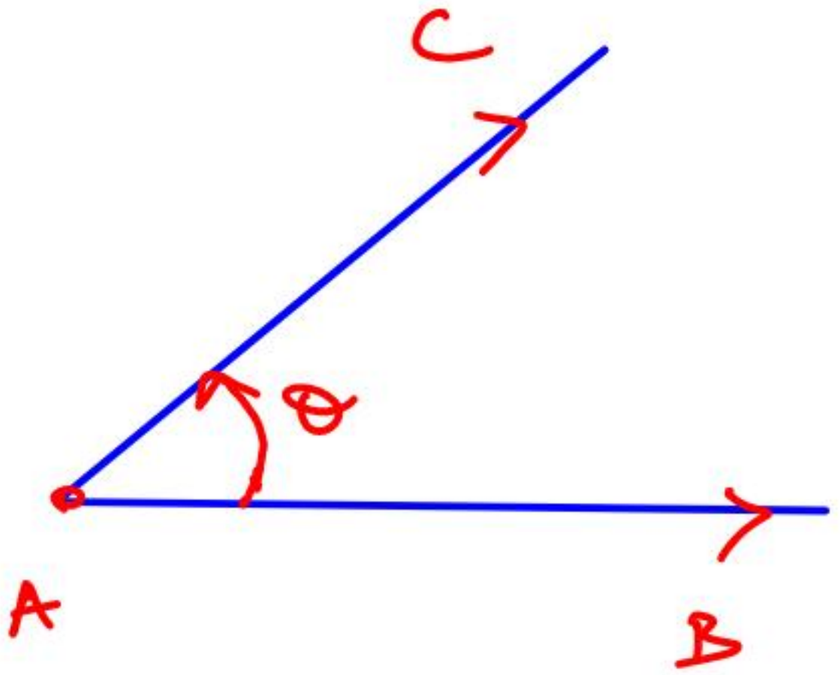
If 3 or more than 3 lines passes through a single point.



Coincident Lines

Two lines that lie on top of one another are called coincident lines.

Angles



∠BAC

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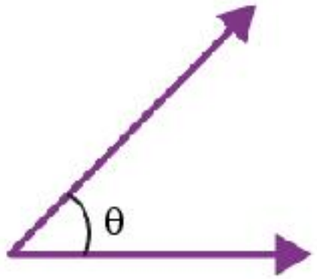
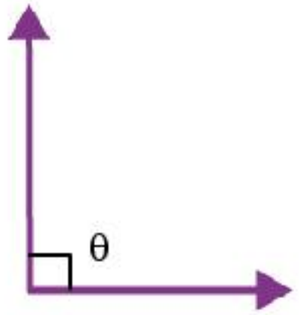
(1) Acute Angle

$0 < \theta < 90$



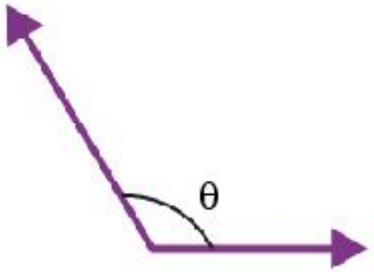
(2) Right Angle

$\theta = 90^{\circ}$



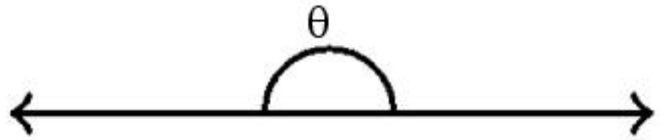
(3) Obtuse Angle

$90 < \theta < 180$



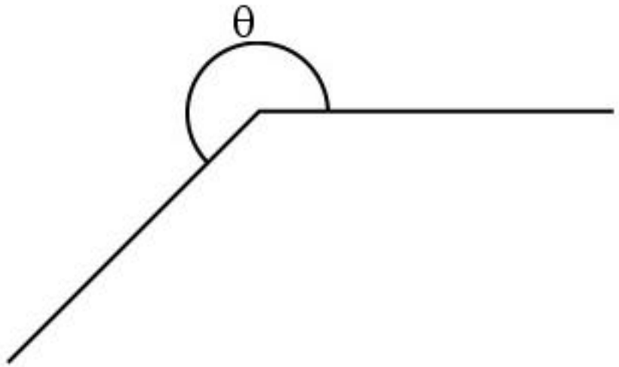
$\theta = 180^\circ$

(4) Straight Angle

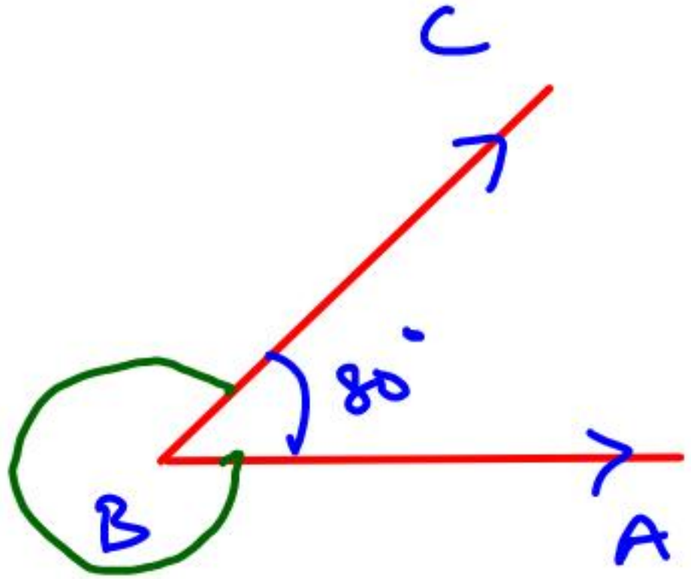


(5) Reflex Angle

$180 < \theta < 360$



eg

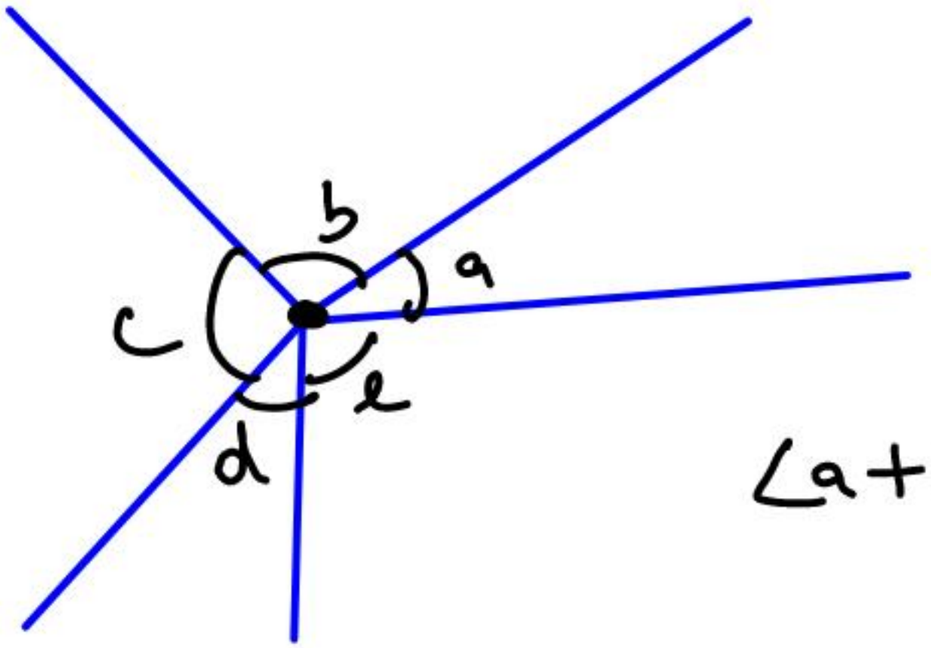


$\angle ABC = 80°$

Reflex angle

$\angle ABC = \underline{280}$

Sum of angles around a point = 360°



$\angle a + \angle b + \angle c + \angle d + \angle e$

$= 360^\circ$

Complementary Angle : $\theta_1 + \theta_2 = 90°$

Supplementary Angle : $\theta_1 + \theta_2 = 180°$

Eg. If one angle is 20% (1/5) less than its supplementary angle. Find the angle.

Angle : Supplementary Angle

4 : 5

$9 \rightarrow 180^\circ$

$1 \rightarrow 20^\circ$

$4 \rightarrow 80^\circ$

Ans. 80°

Adjacent Angle

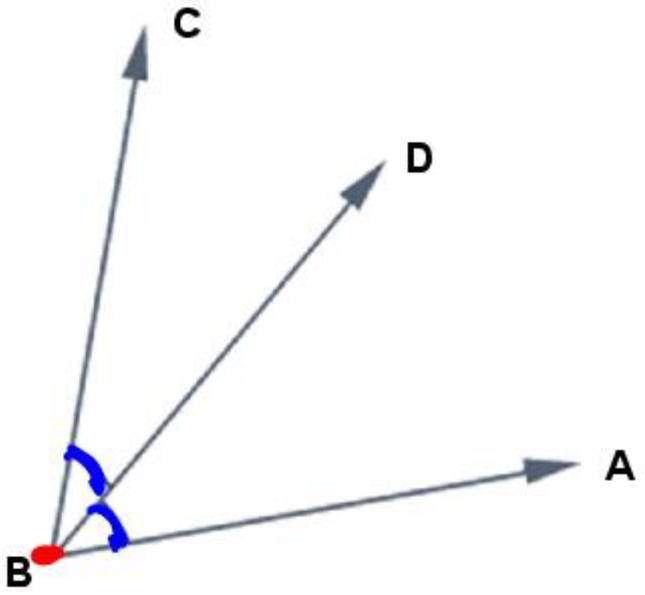
2 angles are said to be **Adjacent.**

(1) Common vertex (B)

(2) Common arm (BD)

(3) Uncommon arm are on opposite side of common arm.

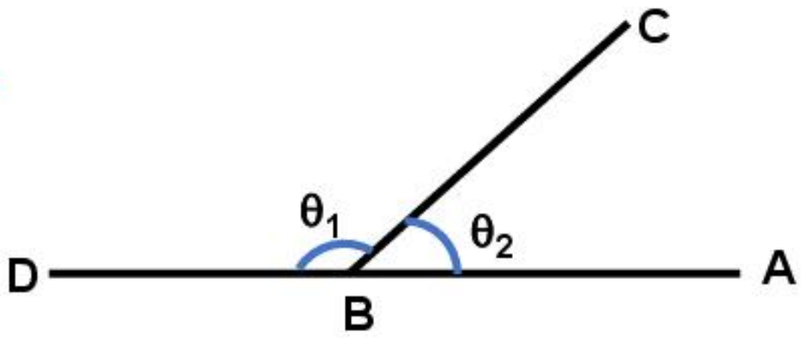
(AB & BC)



∠ABD & ∠DBC

Linear Pair : Pair of adjacent angles where the uncommon arms form a straight line.

$$\theta_1 + \theta_2 = 180°$$

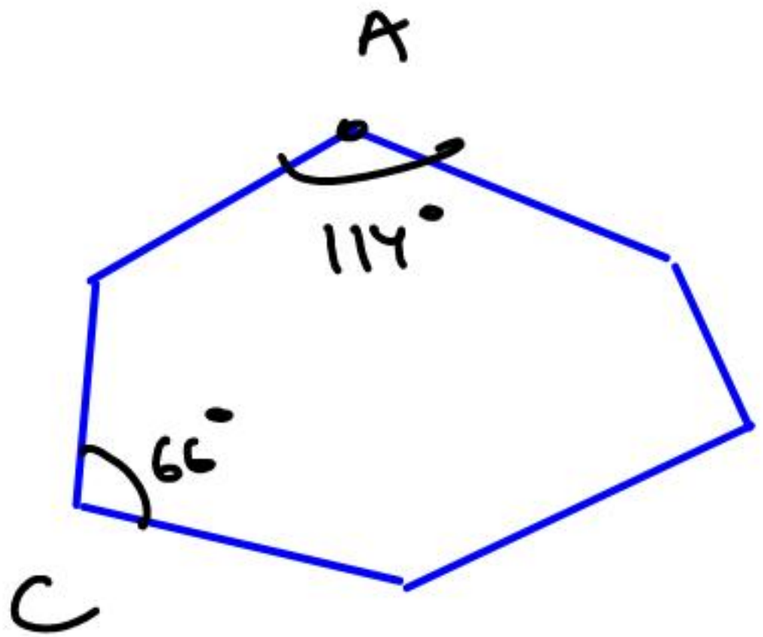


∠ABC & ∠CBD

* what is diff b/w Linear Pair & Supplementary Angles

Linear Pair → cond^n they should be adjacent

Supplementary → No cond^n of Adjacent



$\angle A$ & $\angle C$ are

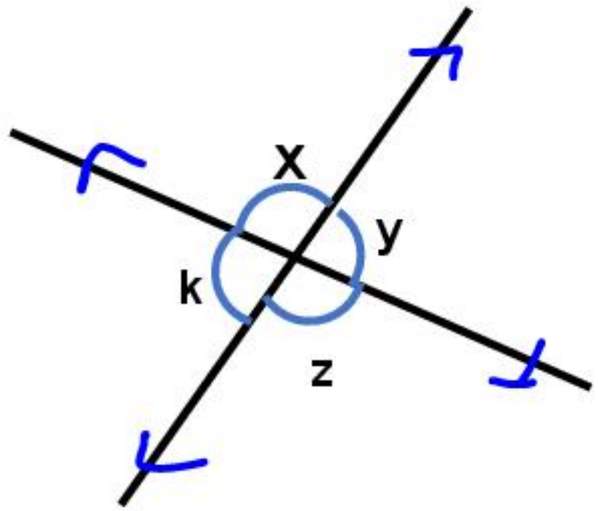
supplementary

Angles

Vertically opposite angle

$\angle x = \angle z$

$\angle y = \angle k$



Reason

$x + y = 180^\circ$ (Linear Pair)

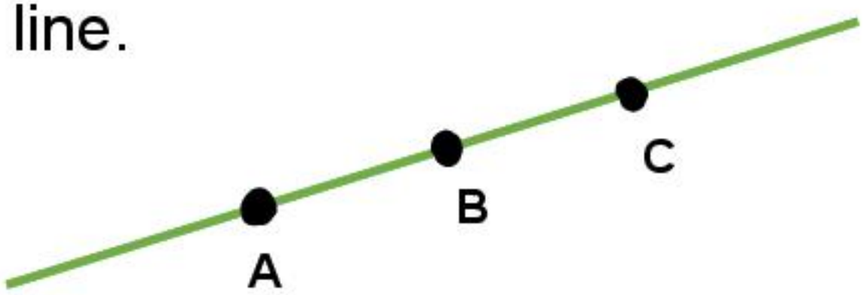
$y + z = 180^\circ$ (Linear Pair)

$x + y = y + z$

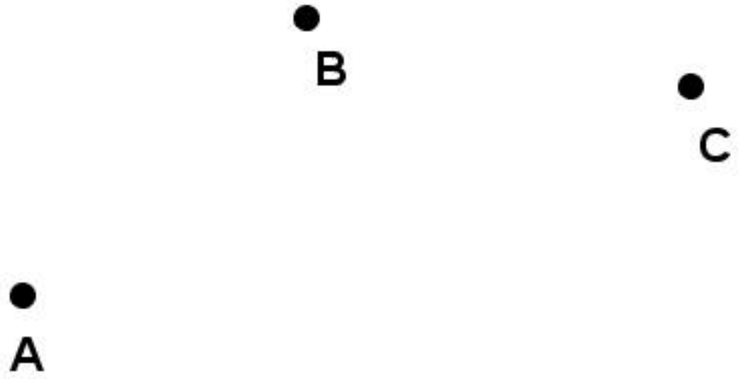
$x = z$

Collinear points :

If 3 or more than 3 points lie on a single line.



Non-Collinear points

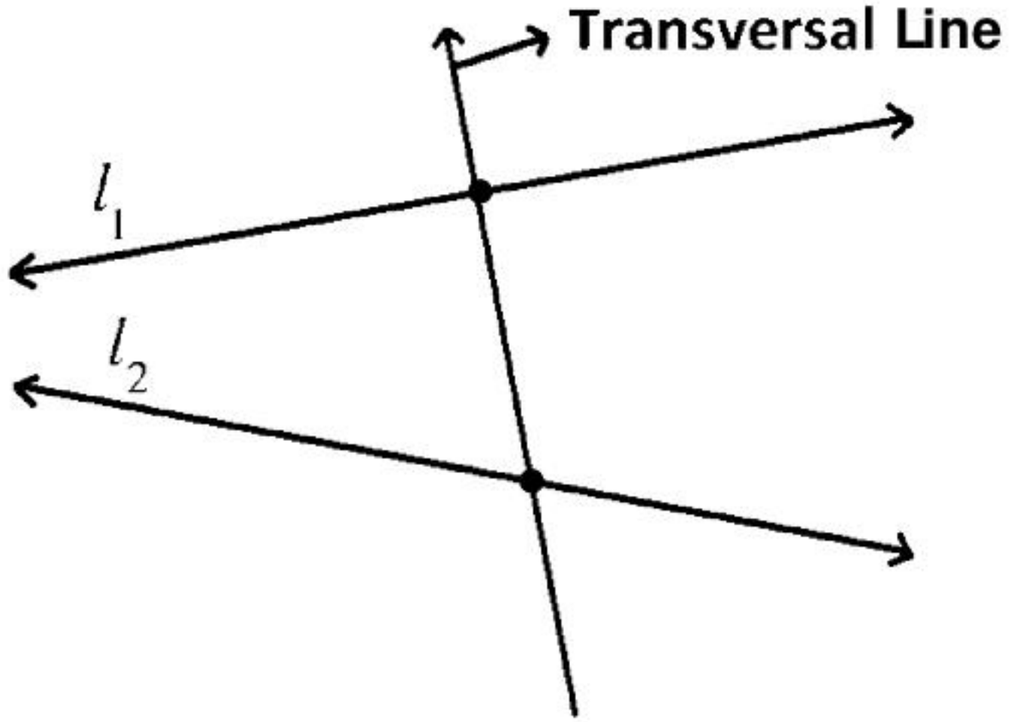


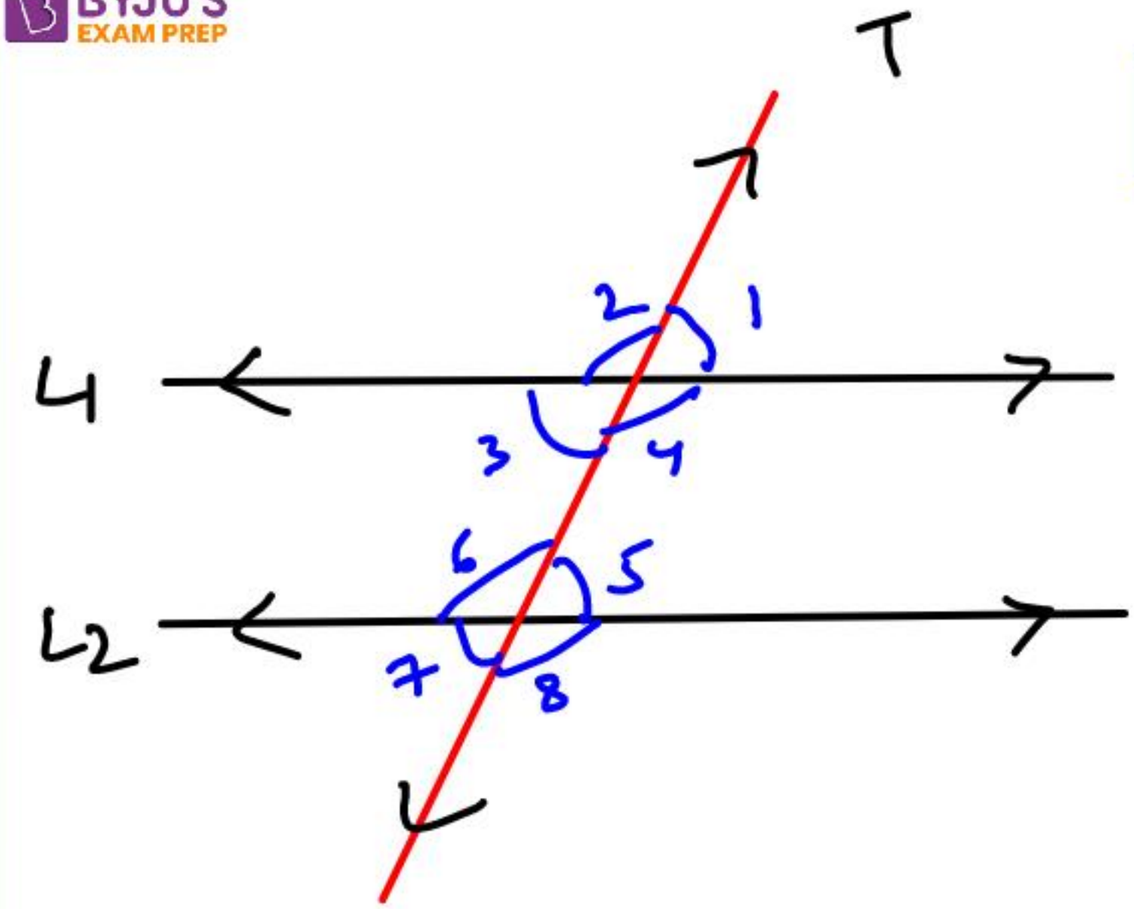
Transversal Line

line which

intersect 2 or more lines

at distinct point





Corresponding Angles

$\angle 1 = \angle 5$ $\quad \angle 2 = \angle 6$

$\angle 3 = \angle 7$ $\quad \angle 4 = \angle 8$

Alternate Interior Angle

$\angle 3 = \angle 5$ $\quad \angle 4 = \angle 6$

Co-interior angle

$\angle 3 + \angle 6 = 180^\circ$

$\angle 4 + \angle 5 = 180^\circ$

If $L_1 \parallel L_2$

T is a Transversal

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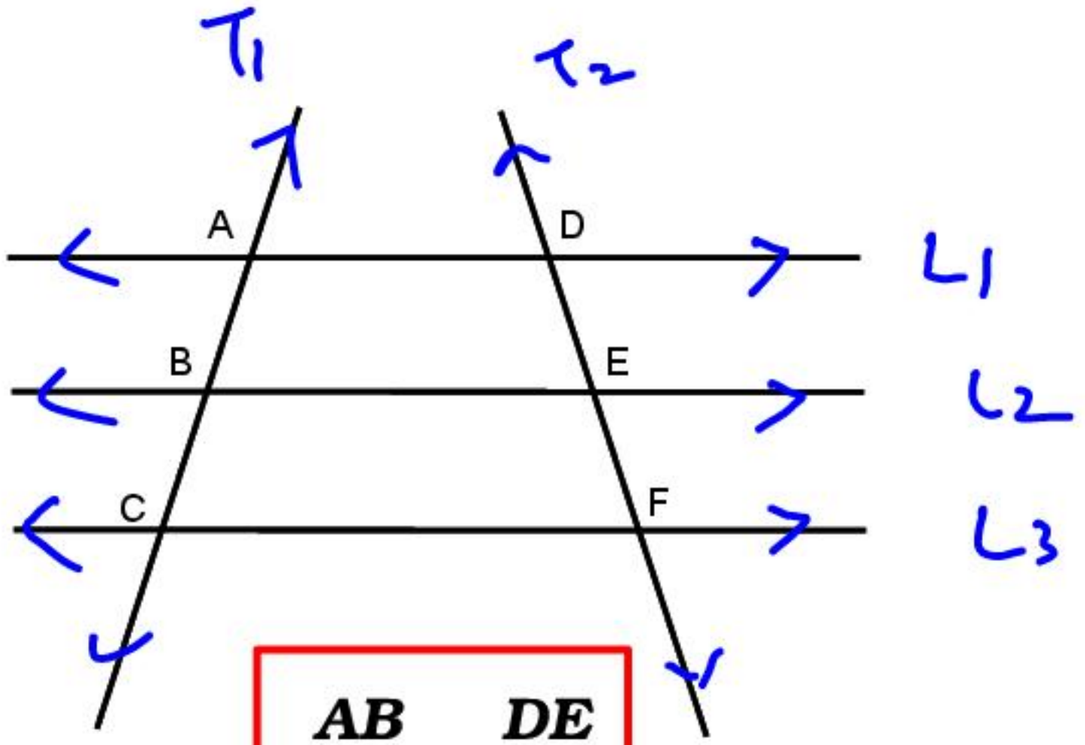
If 2 lines are parallel:

(i) Corresponding angles are equal.

(ii) Alternate interior angle are equal.

(iii) Sum of co-interior angles is 180°.



$$\frac{AB}{BC} = \frac{DE}{EF}$$

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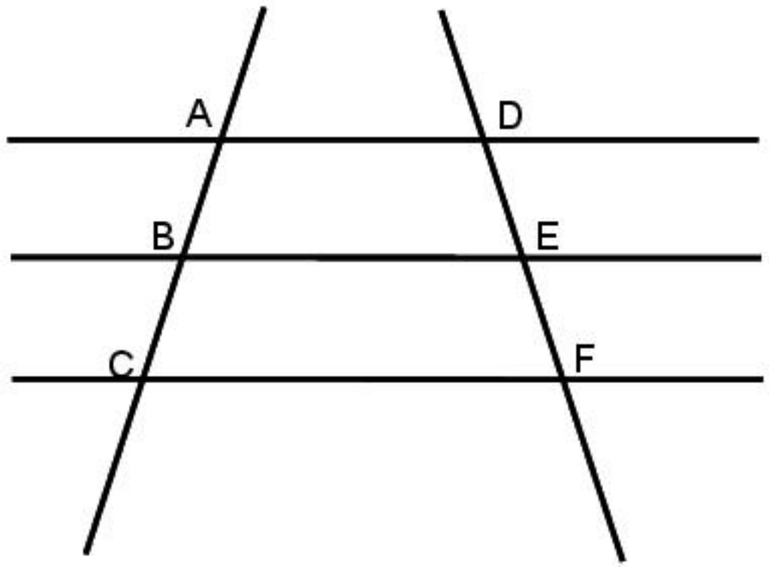
Eg. If AB = 2 cm, BC = 4 cm, DE = 1.5 cm, find DF.



$$\frac{2}{2+4} = \frac{1.5}{EF}$$

$$EF = 3$$

$$DF = DE + EF$$

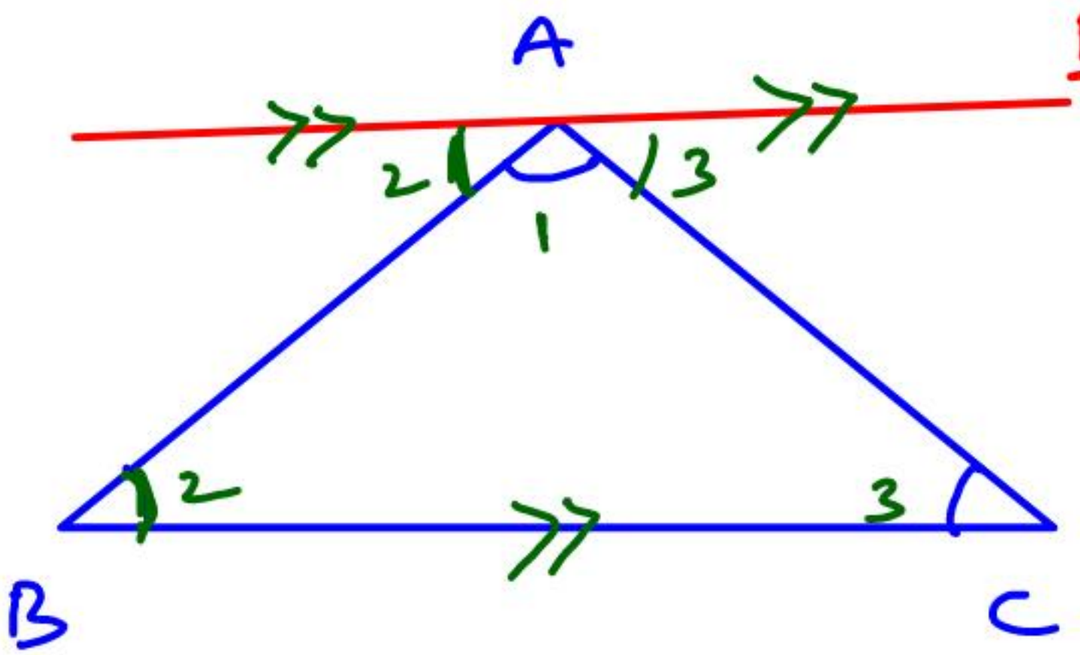
$$= 1.5 + 3$$

$$= 4.5$$

BASIC THEORY OF TRIANGLES

(1) Sum of all angles of a triangle = 180°

$\angle A + \angle B + \angle C = 180°$

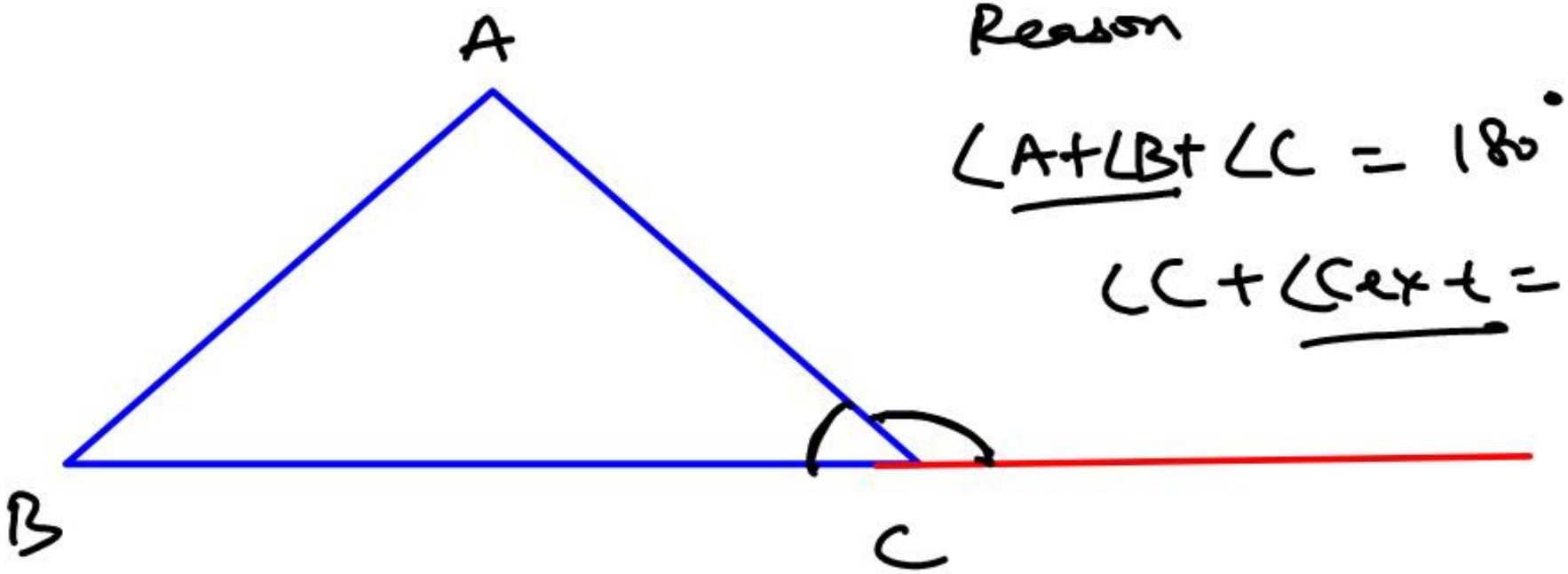


Reason

$\angle 1 + \angle 2 + \angle 3 = 180°$

$\angle A + \angle B + \angle C = 180°$

(2) Exterior angle of a triangle is equal to sum of its interior opposite angle.



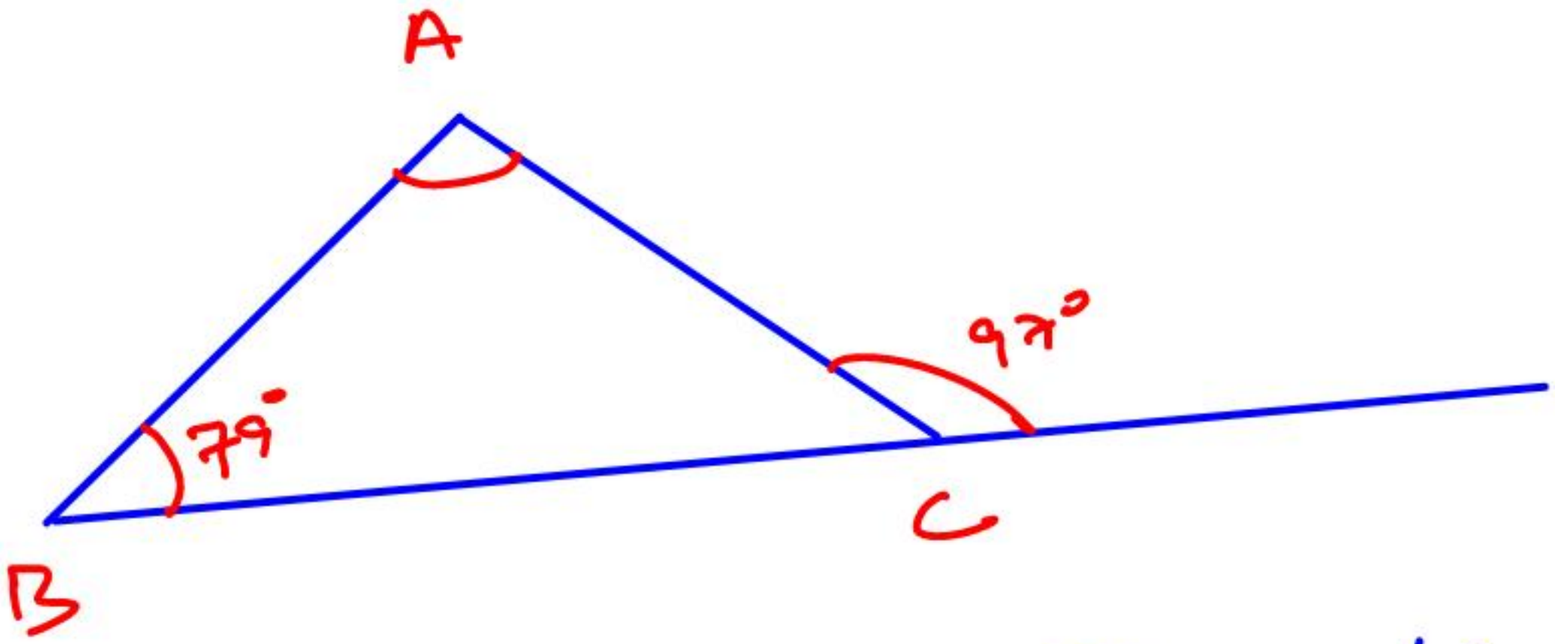
Reason

$\angle A + \angle B + \angle C = 180^\circ$

$\angle C + \angle C_{ext} = 180^\circ$

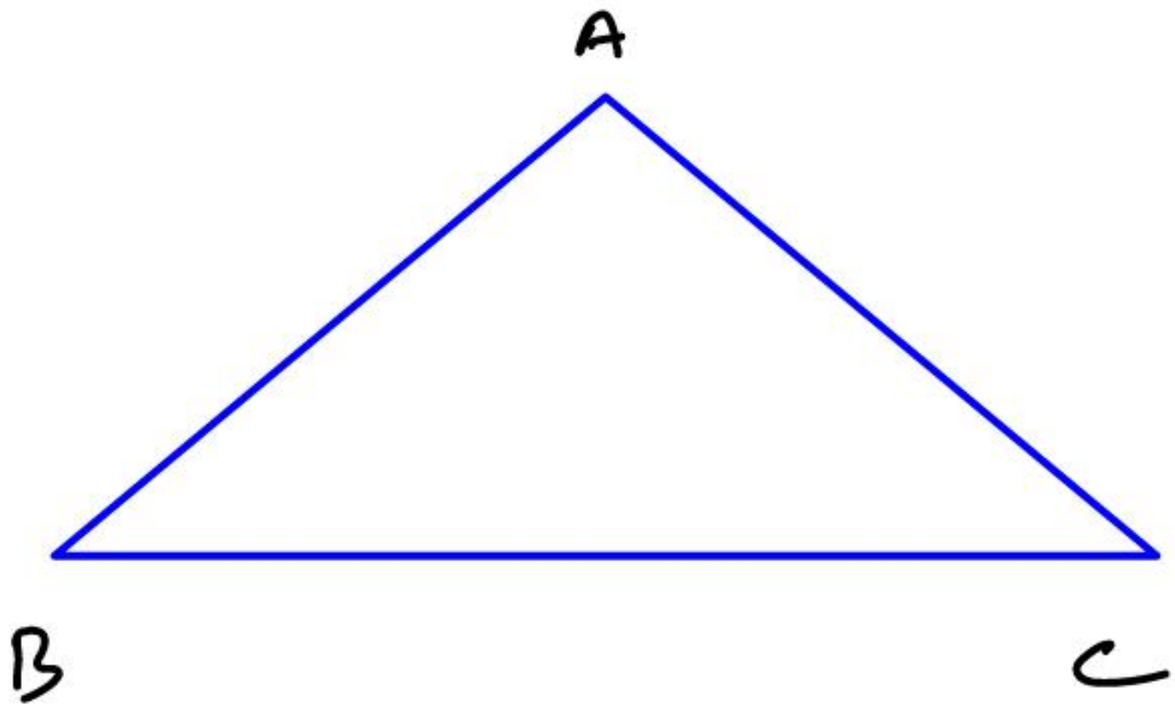
$\angle C_{ext} = \angle A + \angle B$

eg



$\angle A + 79 = 97$ $\angle A = 18^\circ$

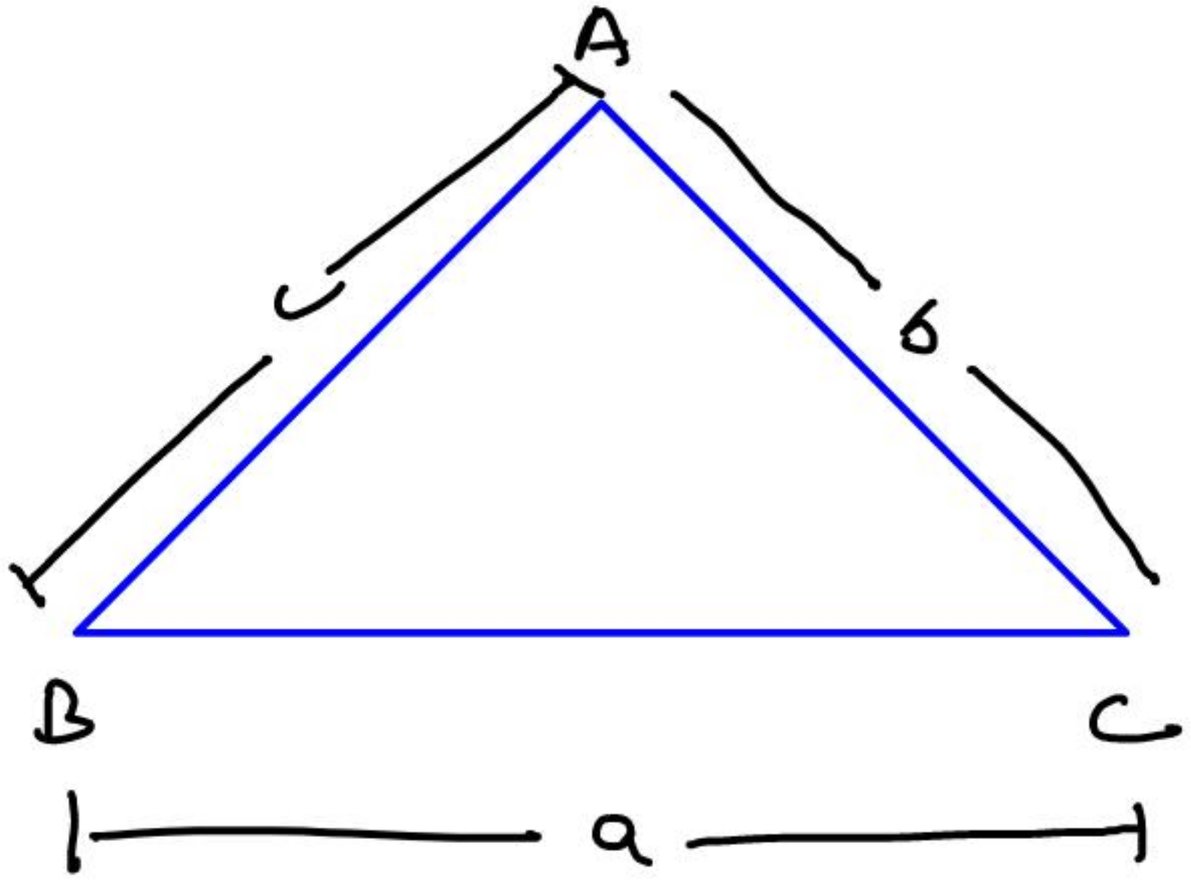
(3) Side opposite to largest angle is largest.



$\angle B > \angle A > \angle C$

$AC > BC > AB$

TYPES OF TRIANGLES



(1) Scalene Triangle : Is a Δ in which all sides are distinct.

$a \neq b \neq c$

(2) Isosceles Triangle : Is a Δ in which atleast 2 sides are equal.

$a = b \neq c$

(3) Equilateral Triangle : Is a Δ in which all sides are equal.

$a = b = c$

Isosceles Triangle :

A triangle in which at least 2 sides are equal.

(Equilateral triangle is also isosceles.)

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(1) Acute Angle Triangle

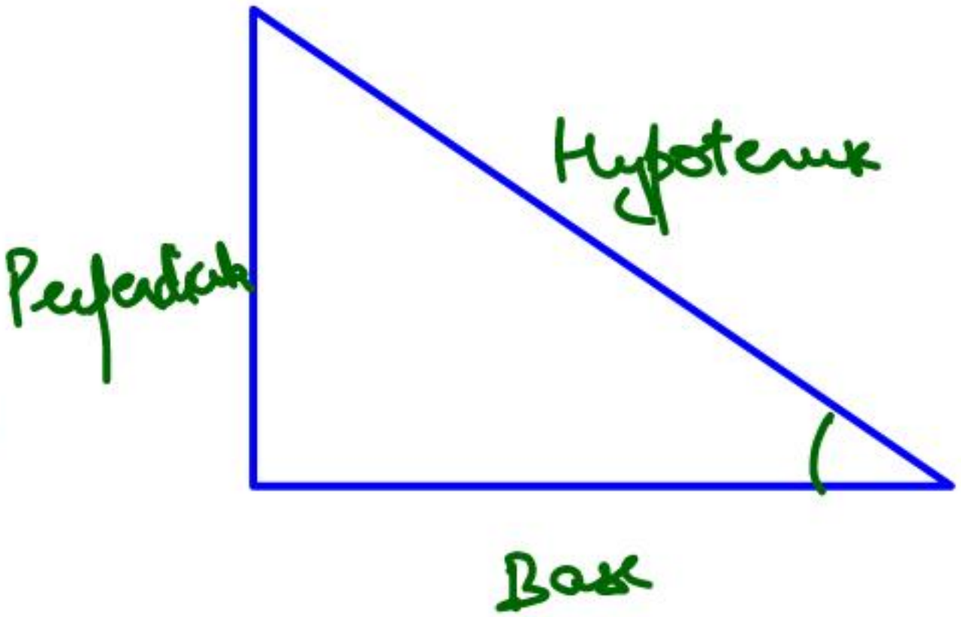
All Angles → Acute

(2) Right Angle Triangle

One Angle → Right angle

(3) Obtuse Angle Triangle

One Angle → Obtuse



$$(B)^2 + (P)^2 = H^2$$

eg 5, 12 & 13

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How to check which type of triangle it is? If length of the sides of triangle are there.

$a \leq b \leq c$

$a^2 + b^2 > c^2$	Acute Angle Δ
$a^2 + b^2 = c^2$	Right angle Δ
$a^2 + b^2 < c^2$	Obtuse angle Δ

Reason → "COSINE RULE"

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5, 6, 8

$5^2 + c^2 \quad 8^2$

$c^1 \quad < \quad 6^4$

Obtuse Angle Δ

5, 6, 7

$5^2 + 6^2 \quad > \quad 7^2$

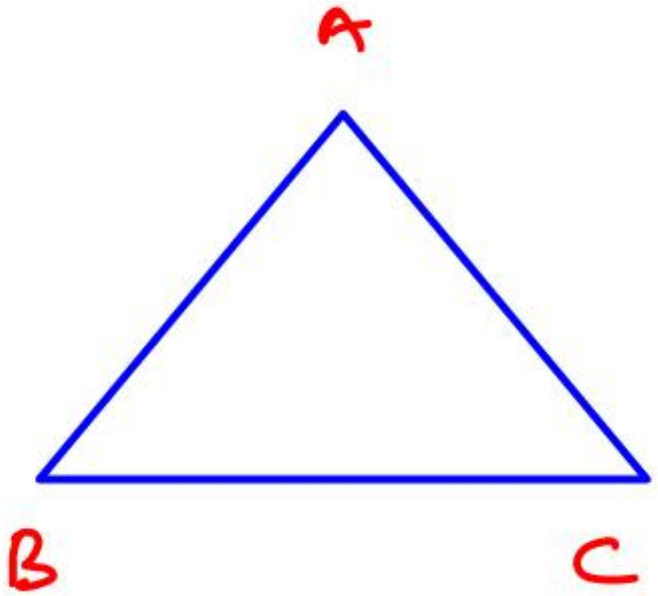
Acute angle Δ

Is Circle a Polygon

→ No

POLYGONS

Def: A polygon is a 'n' sided closed figure formed by line segments.



where $n > 2$

⟶ "Triangle"

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(1) POLYGON

3 side → "Triangle"

4 side → "Quadrilateral"

5 side → "Pentagon"

6 side → "Hexagon"

7 side → "Heptagon"

8 side → "Octagon"

9 side → "Nonagon"

10 side → "Decagon"

(2) REGULAR POLYGON

Both cond^{M} are Required

A polygon in which :

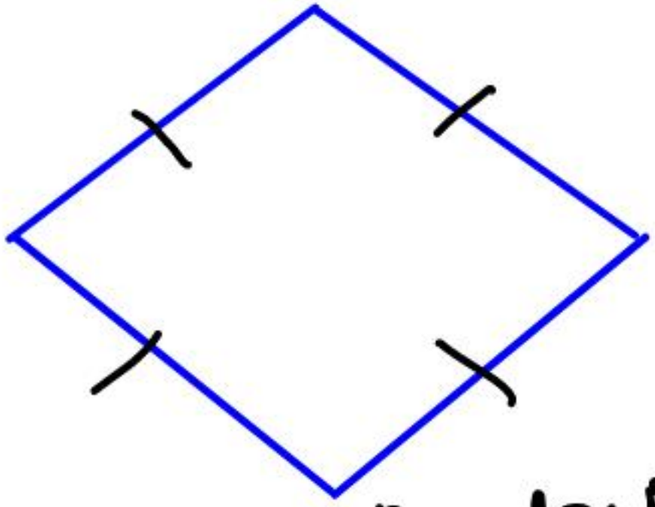
~~(i)~~ all sides are equal.

~~(ii)~~ all angles are equal.

Rectangle

Not a Regular Polygon

Rhombus



Not a Regular Polygon

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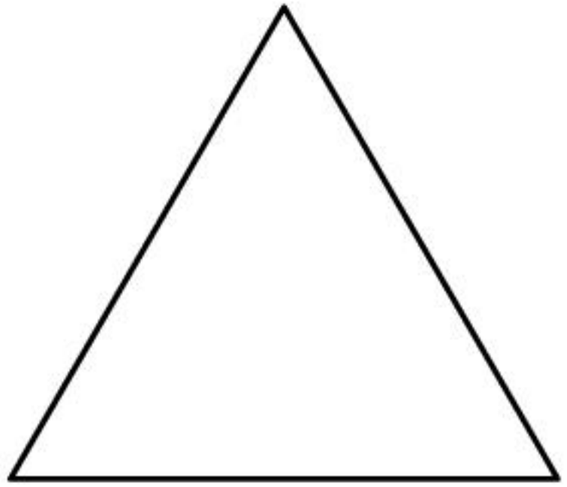
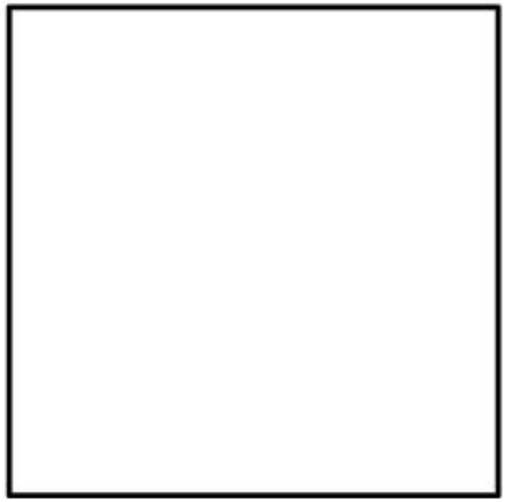
3-SIDED REGULAR POLYGON



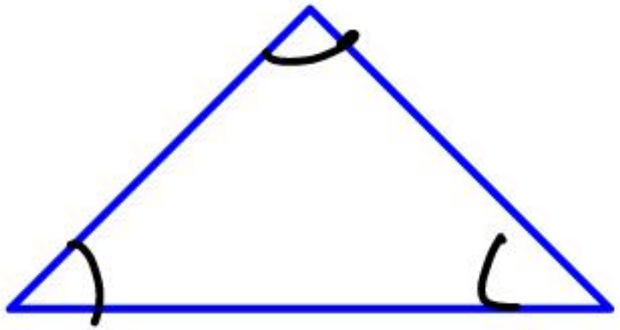
" Equilateral Δ "

4-SIDED REGULAR POLYGON

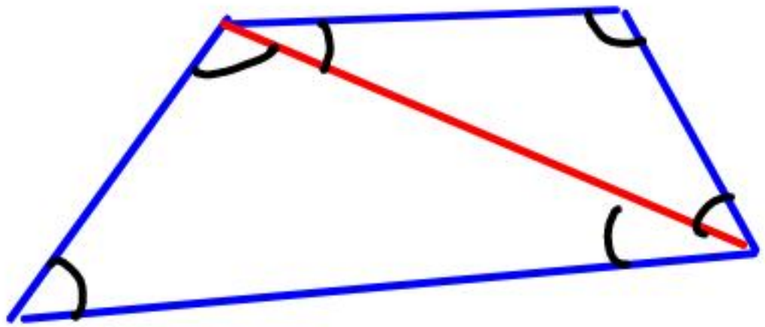


"SQUARE"

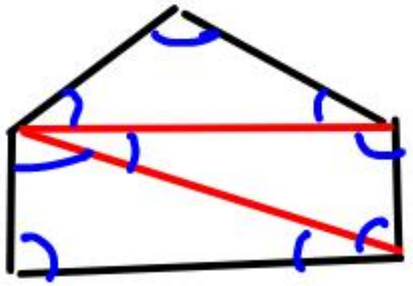
Sum of all internal angles of a polygon of n sides = (n –2) 180°



$\longrightarrow 1 \cdot 180^\circ$



$\longrightarrow 2 \cdot 180^\circ = 360^\circ$



$\longrightarrow 3 \cdot 180 = 540^\circ$

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Eg. Find the sum of all interior angles of a 24 sided polygon.

$(24-2) \cdot 180$

$(22)(180)$

3960

$22 \cdot 18$

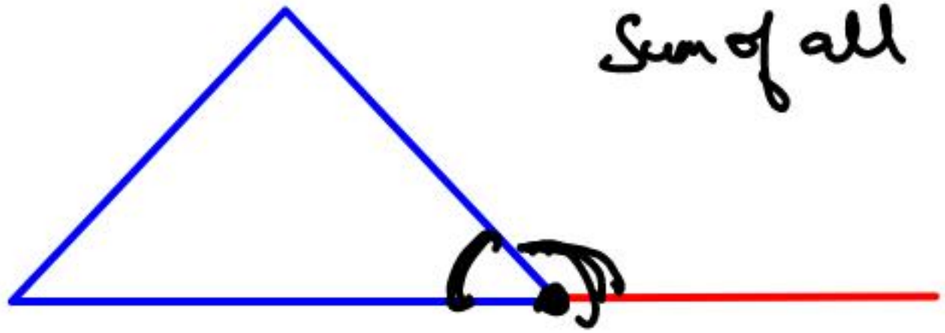
$(20+2)(20-2)$

(20^2-2)

Proof :

Sum of all internal angles of a polygon of n sides = (n –2) 180°

Sum of all exterior angles of a polygon of n sides = 360°



Sum of all (Interior + Exterior) = $180n$

Sum of Exterior Angles

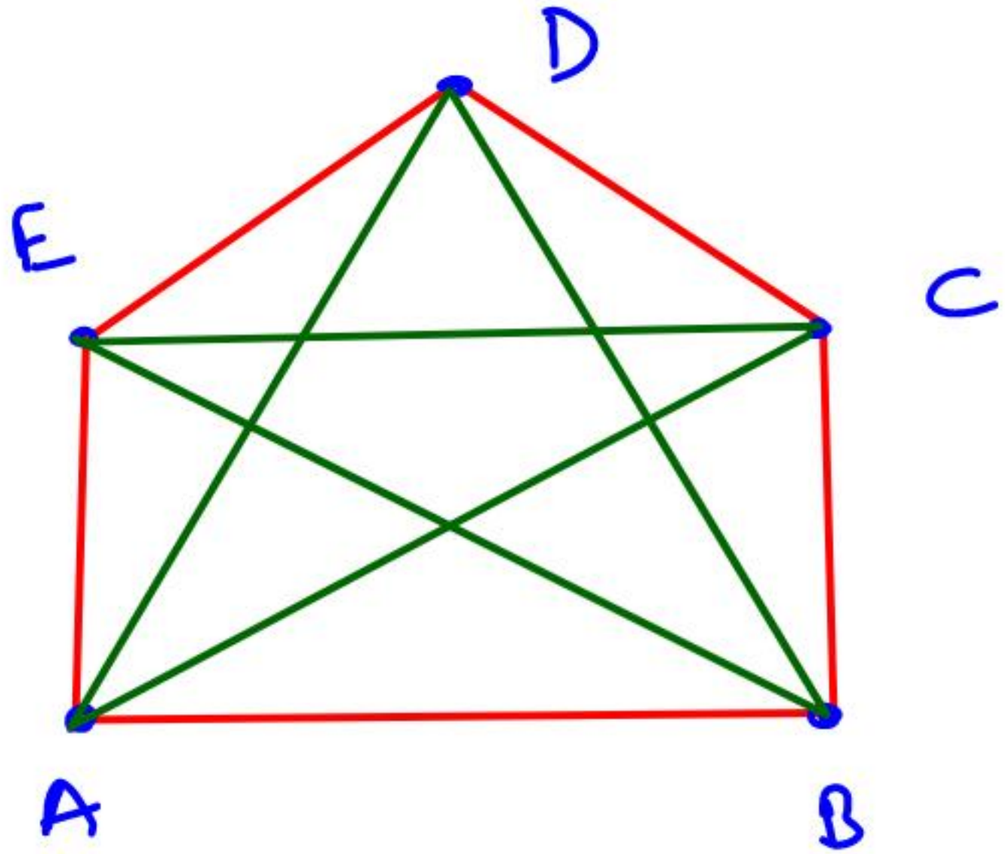
$= 180n - (n-2)180$

$= 360$

Each interior angle of a regular polygon of n sides = $\frac{(n-2)180}{n}$

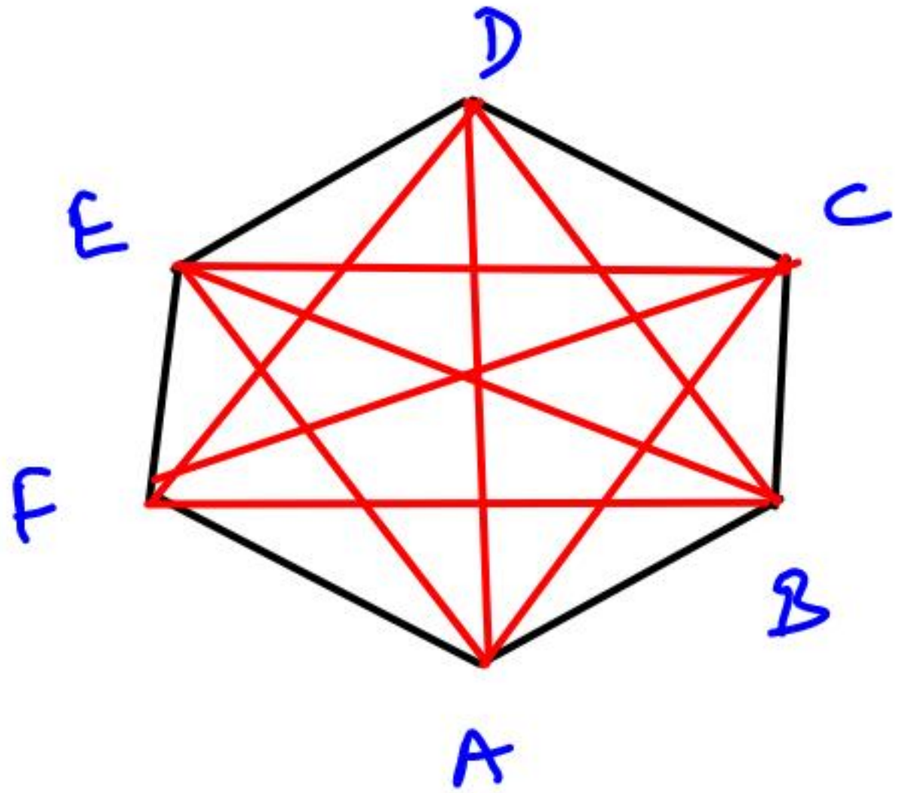
Each exterior angle of a regular polygon of n sides = $\frac{360}{n}$

Diagonal of a Polygon



DIAGONAL OF A POLYGON

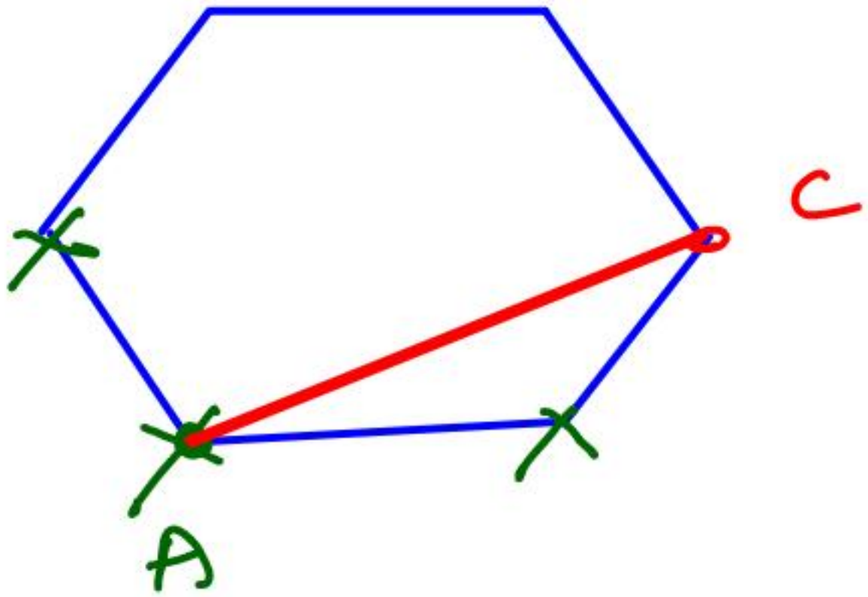
If you join any 2 (non-adjacent) vertex of a polygon then that is a diagonal.



→ 9 diagonals in Hexagon

No. of diagonals in a polygon of n sides = $\frac{n(n-3)}{2}$

Reason



Eg. How many diagonals are there in a 12 sided polygon.

$$\frac{12(12-3)}{2} \Rightarrow \frac{\overset{6}{\cancel{12}} \cdot 9}{\cancel{2}} \Rightarrow 54$$

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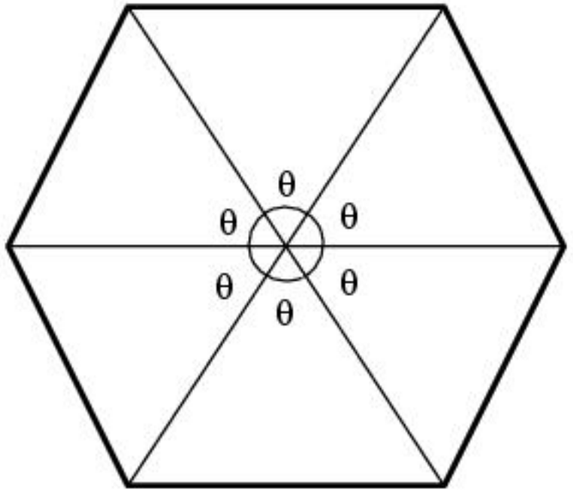
No. of sides (n)	Name of polygon	Sum of all interior angles	Sum of all exterior angles	No. of diagonals	Regular Polygon		
					Name	Each interior	Each exterior
3	Triangle	180°	360°	0	Equilateral Δ	60°	120°
4	Quadrilateral	360°	360°	2	Square	90°	90°
5	Pentagon	540°	360°	5	Regular Pentagon	108°	72°
6	Hexagon	720°	360°	9	Regular Hexagon	120°	60°
n		(n-2) 180°	360°	$\frac{n(n-3)}{2}$		$\frac{(n-2)180}{n}$	$\frac{360}{n}$

Area of a regular polygon of n sides where length of each side is a :

$$n\frac{a^2}{4}\cot\frac{180}{n}$$

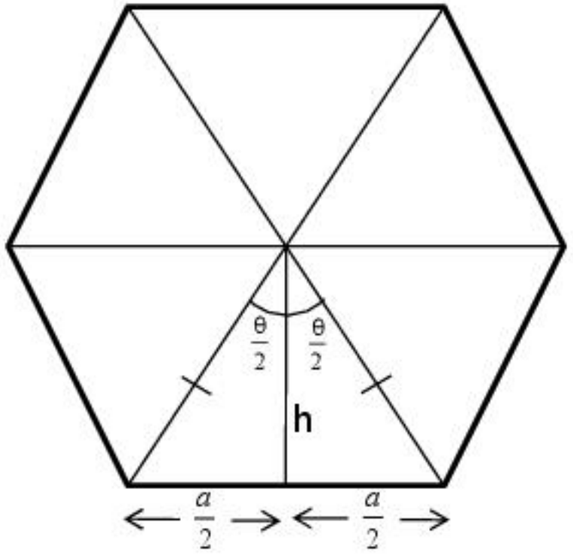
Derivation will be done later



If there are 'n' sides then

$$n \cdot \theta = 360$$

$$\theta = \frac{360}{n}$$



$$\cot\frac{\theta}{2}=\frac{h}{\frac{a}{2}}$$

$$h=\frac{a}{2}\cot\frac{\theta}{2}$$

Area of each Δ = ½ ah

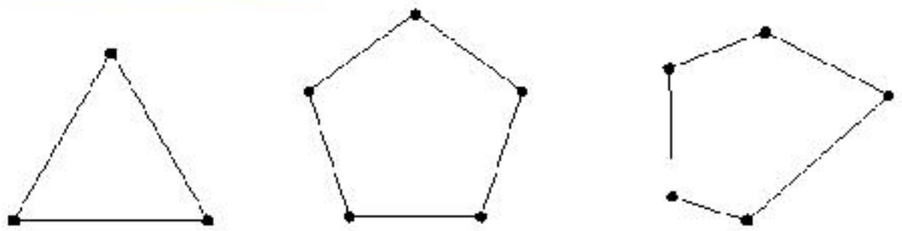
Area of regular polygon = n × ½ ah

$$\frac{na^2}{4}\cot\frac{\theta}{2}$$

$$\frac{na^2}{4}\cot\left(\frac{180}{n}\right)$$

BYJU'S EXAM PREP

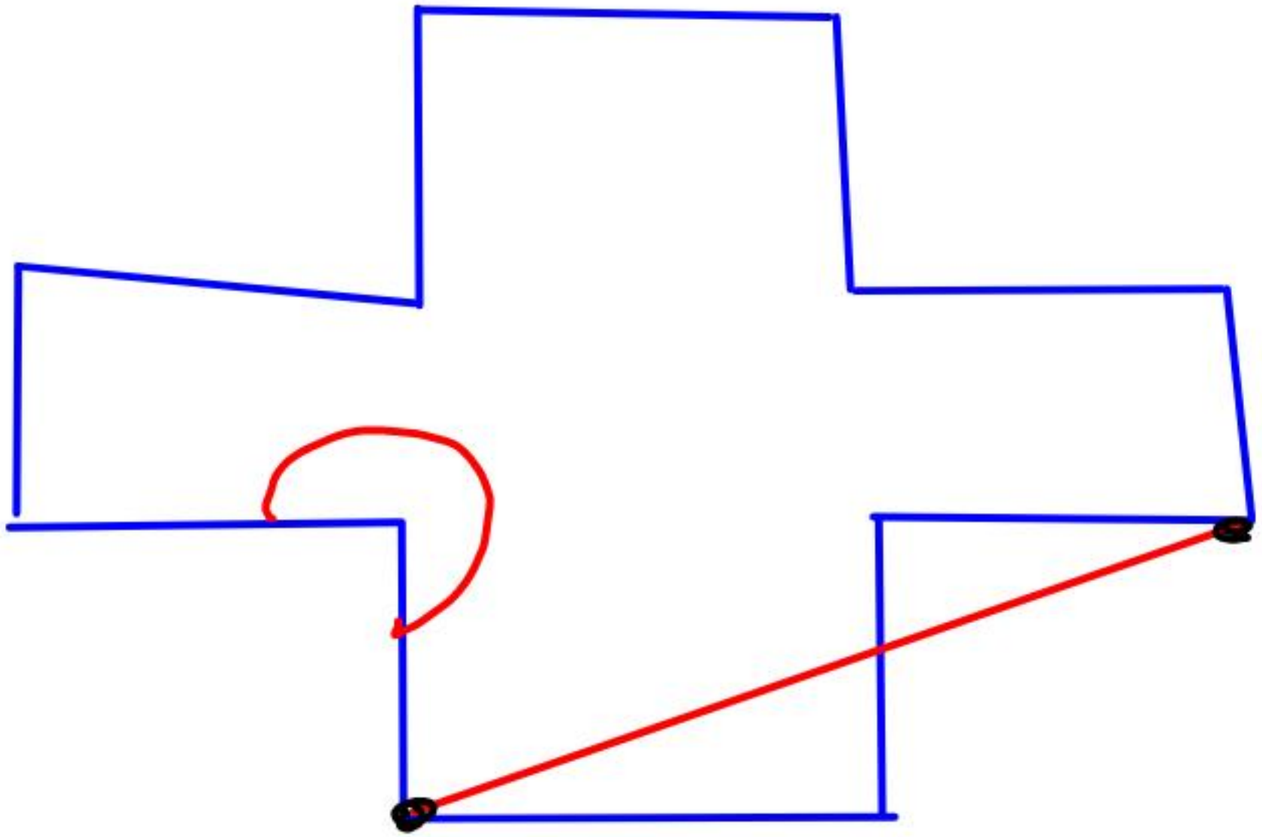
Convex Polygon



(i) All angles are less than 180°.

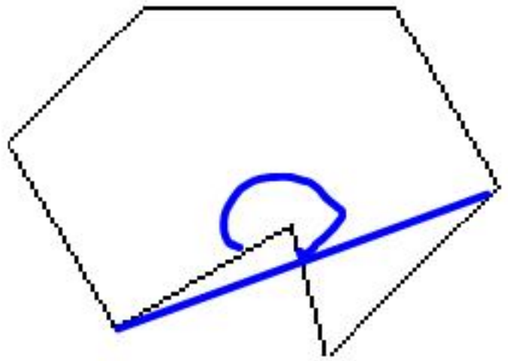
(ii) All diagonals lie inside the polygon.

* If nothing is mentioned in Question we will consider → Convex Polygon



Concave Polygon

Concave Polygon



(i) Atleast one angle > 180º.

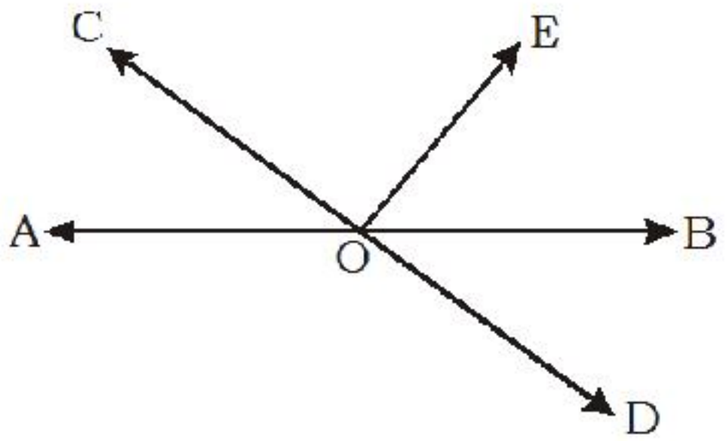
(ii) Atleast one diagonal will lie outside the polygon.

(1) By default, if nothing is given in the question, we consider it as convex polygon.

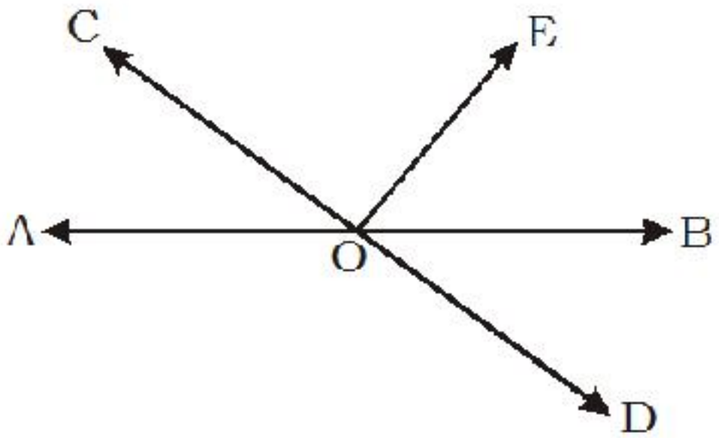
(2) Triangle is always a convex polygon.

(3) All the regular polygons are convex.

Q1. In the given figure lines AB and CD intersect at O. If $\angle AOC + \angle BOE = 70^\circ$ and $\angle BOD = 40^\circ$ then find $\angle BOE$ and reflexive $\angle COE$

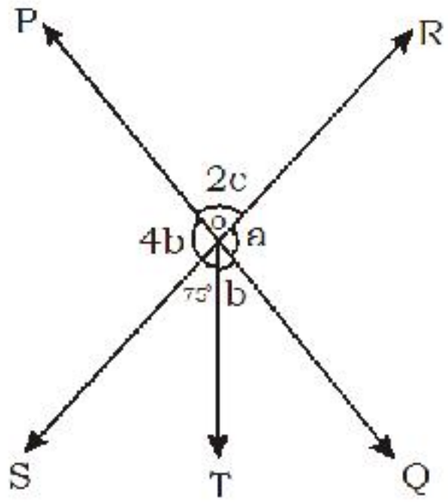


(a) $30^\circ, 250^\circ$ (a) $70^\circ, 250^\circ$ (c) $30^\circ, 210^\circ$ (d) $70^\circ, 210^\circ$

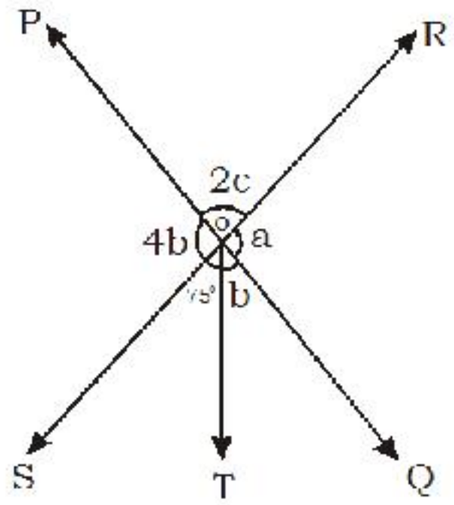

C
E
A
O
B
D

Ans. (a)

Q2. In the given fig. two straight lines PQ and RS intersect each other at O. If ∠SOT = **75**°, find the value of a, b and c.

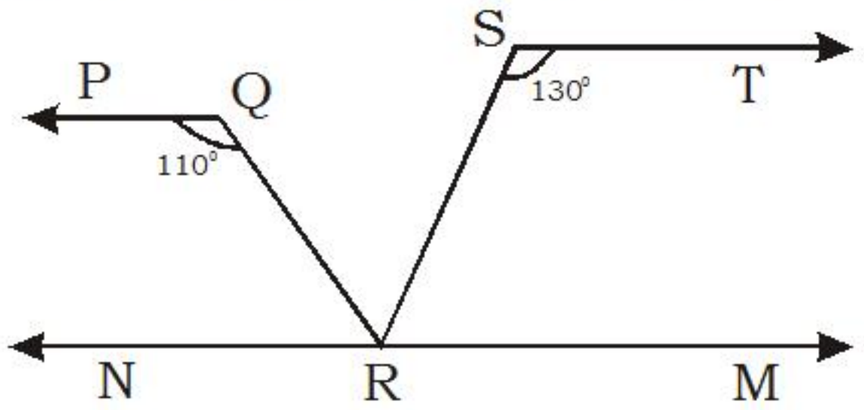


(a) a = 84°, b = 21°, c = 48°
(b) a = 48°, b = 20°, c = 50°
(c) a = 72°, b = 24°, c = 54°
(d) a = 64°, b = 28°, c = 45°

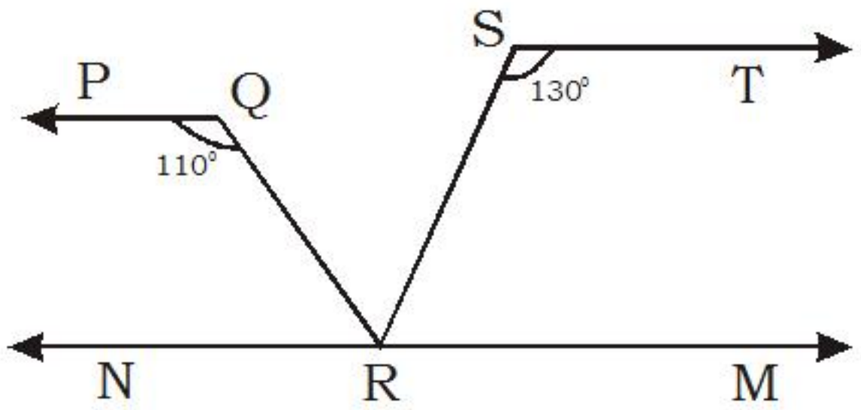

P
R
2c
4b
a
b
S
T
Q

Ans. (a)

Q3. In the given figure if PQ||ST, $\angle PQR = 110^0$ and $\angle RST = 130^0$, find $\angle QRS$



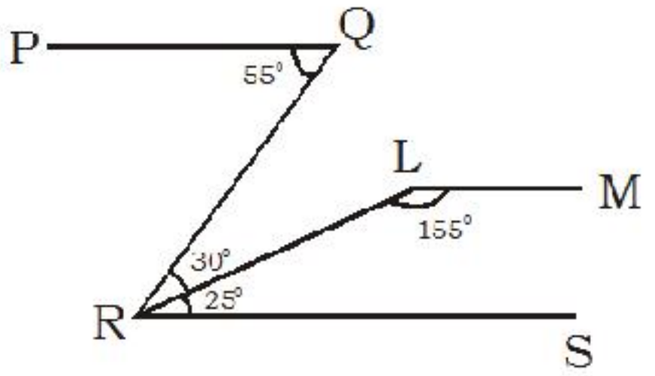
(a) 50^0 (b) 60^0 (c) 70^0 (d) 80^0


S
P
Q
T
130°
110°
N
R
M

Ans. (b)

ANGLE BETWEEN 2 PARALLEL LINES

Q4. In the fig. given below RS is parallel to PQ what is the angle between lines PQ and LM?

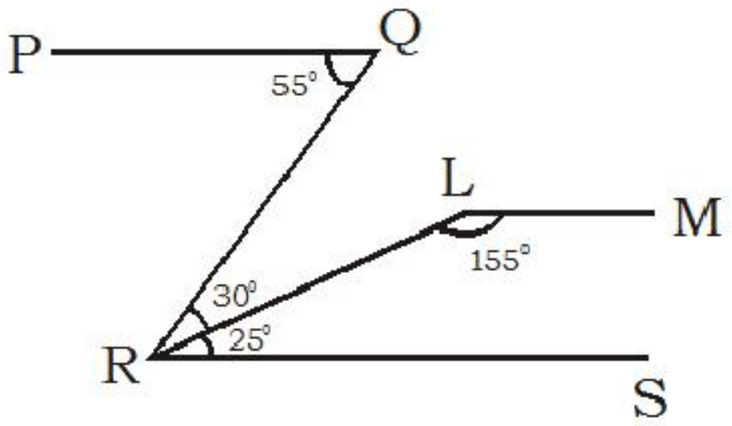


(a) 175°

(b) 177°

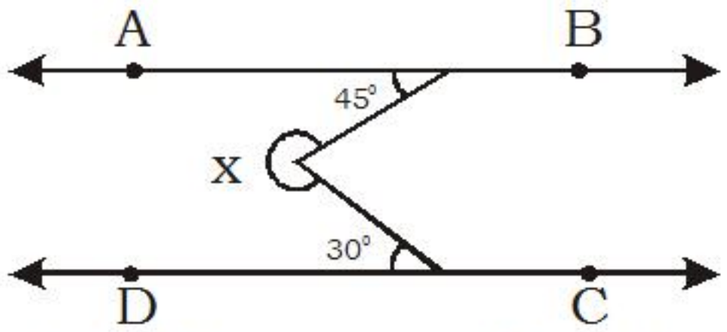
(c) 179°

(d) 180°

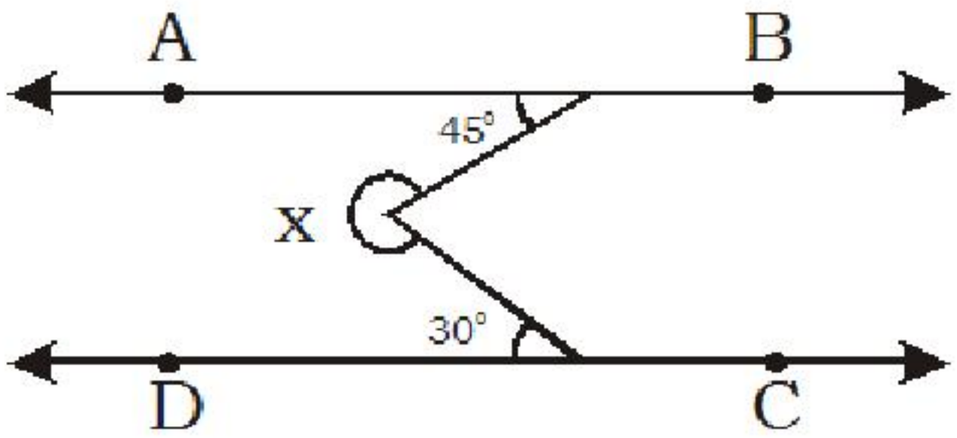

P
Q
55°
L
M
155°
30°
25°
R
S

Ans. (d)

Q5. In the given fig. AB || CD, then x is equal to

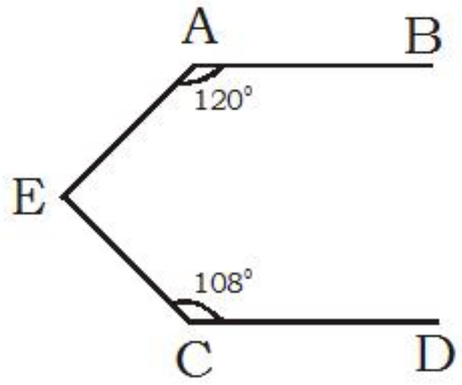


(a) 290^0 (b) 300^0 (c) 280^0 (d) 285^0

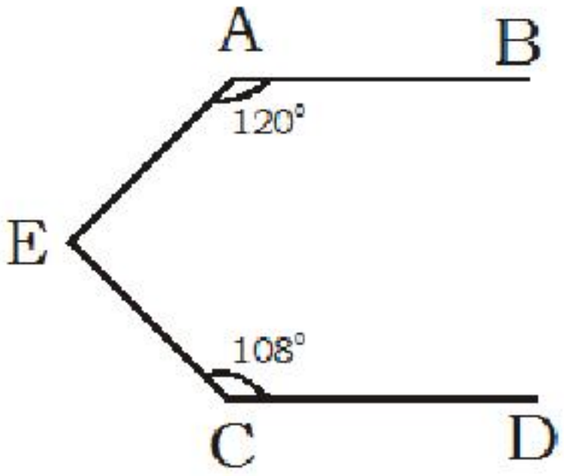

A
B
45°
x
30°
D
C

Ans. (d)

Q6. In the fig. AB ||CD, find ∠AEC

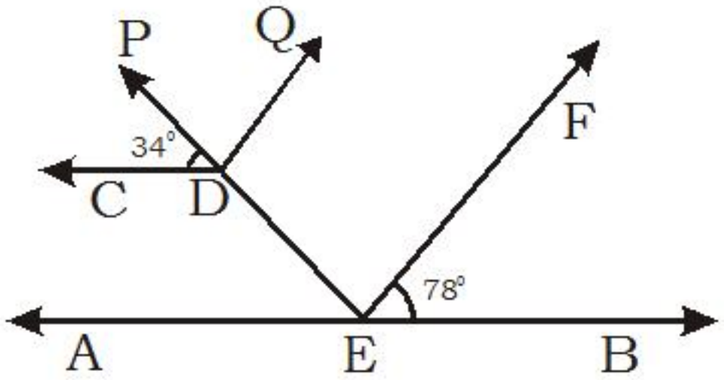


(a) 220° (b)140° (c)150° (d) 132°

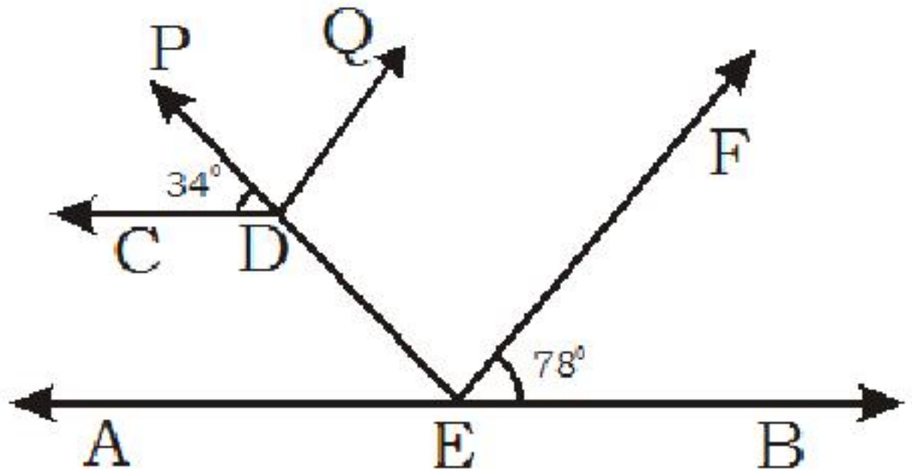

A
B
120°
E
108°
C
D

Ans. (d)

Q7. In the figure AB ||CD and EF||DQ, find the value of ∠PDQ

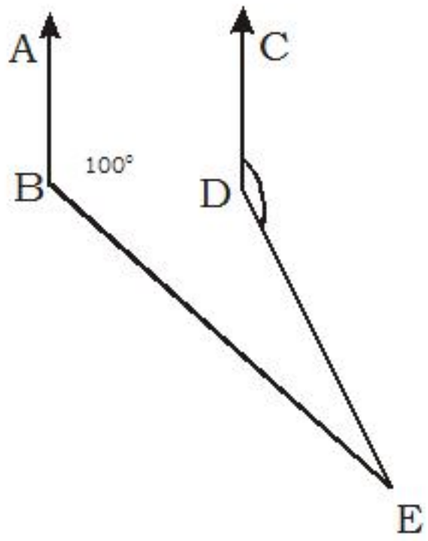


(a) 68^0 (b) 78^0 (c) 56^0 (d) None of these

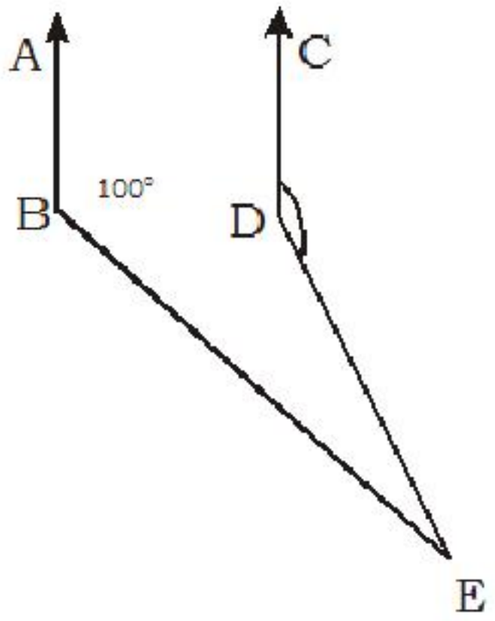

P
Q
F
34°
C
D
78°
A
E
B

Ans. (a)

Q8. In the given figure AB||CD, $\angle ABE = 100^0$ $\angle BED = 25^0$. Find $\angle CDE$

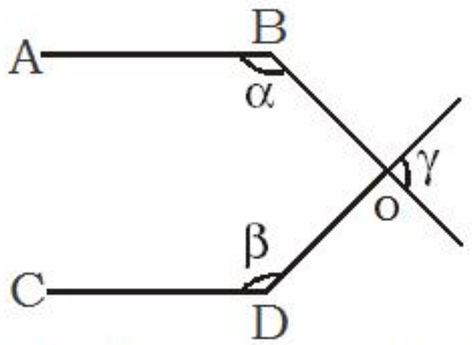


(a) 125^0 (b) 55^0 (c) 65^0 (d) 75^0

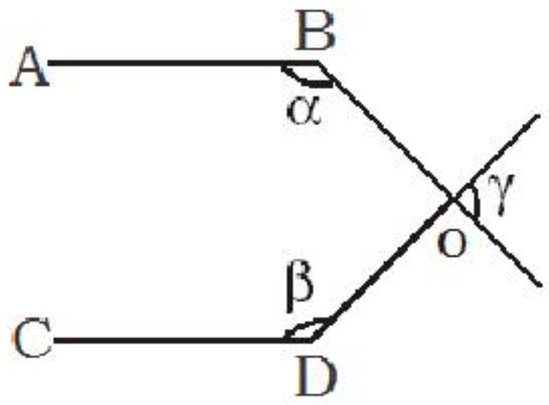

A
C
100°
B
D
E

Ans. (a)

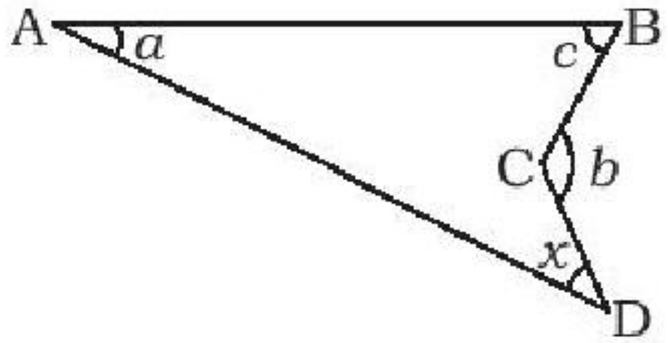
Q9. If AB||CD then find the value of $\alpha+\beta+\gamma$.



(a) 180^0 (b) 270^0 (c) 360^0 (d) 90^0

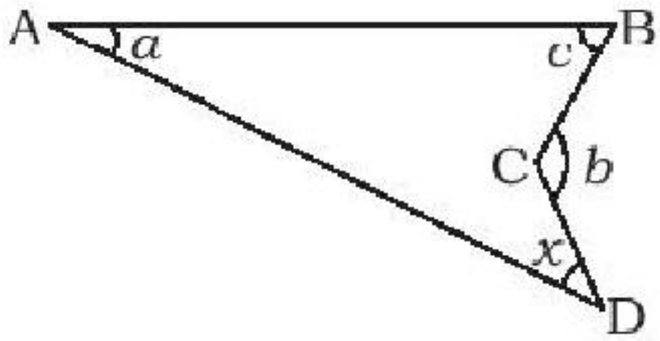

A
B
α
γ
O
β
C
D

Ans. (c)

Q10. 

Find the value of x in above figure.

(a) $b - a - c$
(b) $b - a + c$
(c) $b + a - c$
(d) $\pi - (a + b + c)$


A
a
B
c
C
b
x
D

Ans. (a)